Dr. Winnecke, from the *Mars* observations in 1862, deduced a value 8″·96. This was published in 1863.

Mr. Newcomb's discussion of the *Mars* observations in 1862, published in 1867, gave 8″·855. The smaller value deduced from these *Mars* observations by Mr. Newcomb depends chiefly on the use of the Santiago observations, where the inclination of the wire used was not determined. Mr. Newcomb has attempted to eliminate the errors thus introduced, but I think that the use of these Santiago observations is, under the circumstances, inadmissible.

Hansen's value, deduced from the parallactic inequality in the Moon's motion, is 8″·916. This value was first published in 1867. Hansen had intimated several years before that the parallactic inequality required an increase, but it is doubtful whether he was prepared at that time to throw the whole of this required increase upon an error in the assumed value of the solar parallax. There are also the determinations from the velocity of light which have lately been repeated by M. Cornu, and which, with the accepted value of the coefficient of aberration, lead to a value 8″·86. And there are the classical investigations of Le Verrier, in which, starting with an erroneous value of the ratio of the Sun's mass to that of the Earth deduced from Encke's value of the solar parallax, he not only showed from the theories of the planets themselves that the assumed value of the solar parallax was incorrect, but deduced a value 8″·88, which is entitled to great weight, and is in most satisfactory agreement with the values deduced more directly from observation. If we assume $\pi = 8''{\cdot}89$, the correction which this assumed value requires must be very small. This will correspond to a distance of the Earth from the Sun equal to 91,940,000 miles.

Royal Observatory, Cape of Good Hope,
1878, *January* 18.

On Certain Groups of Stars with Common Proper Motions.

By Prof. T. H. Safford.

It has been long noticed by those who have given attention to the subject of proper motion that there are many groups of stars which seem to have a common proper motion. This tendency has been called star-drift by Mr. Proctor; and the special instance which he has brought prominently forward is that of the group of five stars in *Ursa Major*, β, γ, δ, ϵ, ζ. The motion of these stars is nearly in the same direction, nearly opposed to that which results from the solar motion, but varies in amount from about 0″·09 to 0″·15 yearly.

Upon this subject future determinations will doubtless throw a great deal of light. I am inclined to think that the observations and calculations of the next few years will do much in this direction, as we can now combine good modern observations with ancient ones, not only of Bradley, Lalande, Piazzi, and Groombridge, but also of Struve, Pond, Bessel, and Argelander.

Of the 68 stars within 10° of the North Pole which are reckoned visible to the naked eye (either by Argelander, Heis, or Carrington) about one-half have proper motions whose determination can now be effected with some accuracy. I have already deduced them in a provisional manner, in order to be able to compute more exactly the secular variations and terms of higher orders of the whole motion; or, in other words, to be able to establish formulæ which shall nearly represent observation and be easily corrected.

There are several groups which have proper motions nearly alike in amount and direction.

The first group to which I shall call attention is composed of six stars, whose names (according to Argelander), B.A.C. Nos., rough positions for 1855, and annual proper motions here follow:—

Name.	No. B.A.C.	A.R. h m	Decl. ° ′	$\Delta\alpha$. s	$\Delta\alpha \cos\delta$. ″	$\Delta\delta$. ″
36 *Cephei* H.	8026	22 55·4	83 33·2	+0·05	+0·08	+0·02
39 *Cephei* H.	8213	23 27·8	86 30·4	+0·085	+0·08	+0·01
Bradley 3187	8321	23 49·7	82 23·0	+0·03	+0·06	0·00
Bradley 74	225	0 41·6	82 55·1	+0·04	+0·07	−0·01
43 *Cephei* H. (2 *Ursæ Minoris*).	262	0 49·7	85 28·6	+0·068	+0·08	0·00
Bradley 95	273	0 52·8	86 22·2	+0·07	+0·06	−0·01

It will be seen that a mean proper motion of +0″·07 and 0″·00 is almost as exact for the individual stars as the proper motions can be depended upon, and that the slight deviations in declination indicate that the common motion of all these stars is nearly perpendicular to the equinoctial colure.

Polaris itself has a less proper motion in nearly the same direction; and the small star B.A.C. 240 which precedes it shows traces of a near relationship in its motion, as follows:—

Name.	No. B.A.C.	A.R. h m	Decl. ° ′	$\Delta\alpha$. s	$\Delta\alpha \cos\delta$. ″	$\Delta\delta$. ″
Bradley 65	240	0 45·4	88 14·6	+0·11	+0·05	−0·02
Polaris	360	1 6·5	88 32·2	+0·11	+0·04	0·00

It seems, however, unlikely that the same value of $\Delta\delta$ will represent as fully as is desirable the observations of both stars. This point must be decided by a fuller study.

In the third group are contained three stars:—

Name.	No. B.A.C.	A.R. h m	Decl. ° ′	Δα. s	Δα cos δ. ″	Δδ. ″
Bradley 344	784	2 27·2	80 49·6	+0·02	+0·05	−0·08
Bradley 402	960	3 58·8	84 23·1	+0·04	+0·06	−0·09
Radcliffe 1311	...	4 41·0	85 45·2	+0·04	+0·04	−0·09

The parallelism of motion here is not quite so striking, but will need further observations either to prove or disprove.

Two other stars make a pretty sure pair, namely:—

Name.	No. B.A.C.	A.R. h m	Decl. ° ′	Δα. s	Δα cos δ. ″	Δδ. ″
Groombridge 1850	4070	11 57·4	86 23·4	−0·06	−0·05	+0·06
6 *Ursæ Minoris* B.	4165	12 14·4	88 30·2	−0·094	−0·04	+0·07

Still two others are quite doubtful, although agreeing in amount more nearly than the two stars β and ζ *Ursæ Majoris*:—

Name.	No. B.A.C.	A.R. h m	Decl. ° ′	Δα. s	Δα cos δ. ′	Δδ. ″
30 *Camelop.* H.	3528	10 13·0	83 17·6	−0·052	−0·09	+0·03
202 *Camelop.* B.	3906	11 21·4	81 58·5	−0·06	−0·13	+0·04

As to the dependence to be placed on these numbers, it is naturally not very large. They are, however, pretty fairly substantiated by the evidence, which in nearly all the cases is abundant. How they were discussed may be seen from the following table for the last star mentioned, giving the positions reduced to 1855:—

	h m s	° ′ ″	C−O. s	C−O. ″
Groombridge	11 21 28·9	81 58 28·1	−0·1	−0·1
Struve 1815	28·3	...	+0·2	...
Schwerd 1828	27·5	29·1	+0·2	−0·4
Radcliffe	26·8	28·3	−0·1	+1·1
Yarnall 1846·8	27·1	...	−0·5 (1 observation).	...
Carrington	26·4	30·1	−0·3	−0·3
H.C. 1865	25·5	...	0·0	...
Yarnall 1869	...	30·6	...	−0·2

These figures were obtained at second-hand in several cases, so I only wished to gain approximate positions and proper motions in order to calculate precessions and secular variations (the latter including terms depending on proper motion) with the needful precision. The larger proper motions in this region are mostly well known. The star 223 *Camelop.* Bode = B.A.C. 4982 is the chief exception to this statement. Its annual proper motion is about $+0^{s}\cdot10$ in A.R. and $-0''\cdot27$ in Declination, which, at $6°\cdot9$ from the Pole, amounts to rather more than $0''\cdot3$ in arc.

Williams College, Williamstown, Mass., U.S.A.
1878, *January* 12.

Ephemeris for Physical Observations of Jupiter, 1878. By A. Marth, Esq.

0h G.M.T.	Angle of Position of ♃'s Axis.	Longitude of ♃'s Meridian directed to the Earth.	Diff.	Latitude of Earth above ♃'s Equator.	Latitude of Sun above ♃'s Equator.	Annual Parallax.	Equat. Diam.	Greatest Phase. Prec. side.	Corr. of Long.
1878.	°	°	°	°	°	°	″	″	°
Apr. 25	343·89	126·04		−0·74	−1·08	−11·28	38·71	0·374	+0·55
			4352·98						
30	343·74	159·02		·71	1·06	11·28	39·33	·380	·55
			3·05						
May 5	343·62	192·07		−0·68	−1·04	−11·20	39·96	·381	+0·55
			3·12						
10	343·52	225·19		·65	1·02	11·05	40·61	·376	·53
			3·19						
15	343·45	258·38		·63	1·00	10·83	41·27	·368	·51
			3·25						
20	343·41	291·63		·61	0·98	10·53	41·93	·353	·48
			3·32						
25	343·39	324·95		·59	·95	10·14	42·60	·333	·45
			3·39						
30	343·40	358·34		·58	·93	9·67	43·25	·307	·41
			3·45						
June 4	343·44	31·79		−0·56	−0·91	−9·13	43·89	·278	+0·36
			3·50						
9	343·51	65·29		·55	·89	8·51	44·51	·245	·32
			3·56						
14	343·60	98·85		·54	·87	7·81	45·10	·209	·27
			3·60						
19	343·71	132·45		·54	·85	7·04	45·65	·172	·22
			3·64						
24	343·85	166·09		·53	·82	6·21	46·15	·135	·17
			3·68						
29	344·02	199·77		·53	·80	5·31	46·60	·100	·12
			3·69						
July 4	344·20	233·46		−0·53	−0·78	−4·36	46·99	·068	+0·08
			3·71						
9	344·40	267·17		·54	·76	3·36	47·30	·041	·05
			3·71						
14	344·62	300·88		·54	·74	2·33	47·54	·020	·02
			3·71						
19	344·85	334·59		·55	·71	1·27	47·70	·006	+ ·01
			3·68						
24	345·08	8·27		·56	·69	−0·19	47·77	foll. side	·00
			3·64						
29	345·32	41·91		·57	·67	+0·88	47·76	·003	·00
			3·58						
Aug. 3	345·56	75·49		−0·58	−0·65	+1·95	47·66	·014	−0·02
			3·54						
8	345·79	109·03		·59	·62	3·00	47·47	·033	·04
			3·47						
13	346·02	142·50		·60	·60	4·02	47·21	·058	·07
			3·39						

h G.M.T.	Angle of Position of ♃'s Axis.	Longitude of ♃'s Meridian directed to the Earth.	Diff.	Latitude of Earth above ♃'s Equator.	Latitude of Sun above ♃'s Equator.	Annual Parallax.	Equat. Diam.	Greatest Phase. Prec. side.	Corr. of Long.
1878.	°	°	°	°	°	°	″	″	°
Aug. 18	346·23	175·89		·61	·58	4·99	46·87	·089	·11
			3·31						
23	346·42	209·20		·62	·55	5·91	46·47	·123	·15
			3·22						
28	346·59	242·42		·63	·53	6·77	46·00	·161	·20
			3·13						
Sept. 2	346·73	275·55		—0·64	—0·51	+7·57	45·49	·198	−0·25
			3·02						
7	346·84	308·57		·64	·49	8·30	44·93	·235	·30
			2·93						
12	346·93	341·50		·65	·46	8·95	44·33	·270	·35
			2·82						
17	346·98	14·32		·65	·44	9·52	43·71	·301	·40
			2·73						
22	347·01	47·05		·65	·42	10·02	43·08	·329	·44
			2·63						
27	347·00	79·68		·65	·39	10·43	42·43	·351	·47
			2·53						
Oct. 2	346·96	112·21		−0·65	−0·37	+10·75	41·77	·367	−0·50
			2·44						
7	346·88	144·65		·65	·35	11·00	41·12	·378	·53
			2·36						
12	346·78	177·01		·64	·33	11·17	40·48	·383	·54
			2·27						
17	346·64	209·28		·64	·30	11·26	39·85	·383	·55
			2·20						
22	346·48	241·48		·63	·28	11·28	39·23	·379	·55
			2·13						
27	346·29	273·61		·61	·26	11·23	38·63	·370	·55
			2·06						
Nov. 1	346·08	305·67		−0·60	−0·23	+11·11	38·05	·365	−0·54
			2·00						
6	345·84	337·67		·58	·21	10·93	37·50	·340	·52
			1·94						
11	345·59	9·61		·56	·19	10·68	36·97	·320	·50
			1·90						
16	345·31	41·51		·54	·16	10·38	36·47	·298	·47
			4351·86						
21	345·02	73·37		−0·52	−0.14	+10·03	36·00	0·275	−0·44

Assumed daily rate of rotation 870°·60. The "annual parallax" is the difference of the Jovicentric longitudes of the Sun and Earth, reckoned in the plane of *Jupiter's* equator. The last column gives the correction, which is to be applied to the "longitude of the meridian directed to the Earth," in order that it may refer to the meridian which bisects the illuminated disk. The inclinations γ and the ascending nodes Γ of the orbits of the satellites in reference to the plane of *Jupiter's* equator are the following, the nodes being reckoned from the descending node of the equator on the planet's orbit, or from the vernal equinox of *Jupiter's* northern hemisphere:—

	Sat. I.		Sat. II.		Sat. III.		Sat. IV.	
1878.	γ_1	Γ_1	γ_2	Γ_2	γ_3	Γ_3	γ_4	Γ_4
	°	°	°	°	°	°	°	°
Feb. 24	0·0097	30·8	0·4553	37·42	0·1942	271·14	0·3254	330·22
April 25	97	28·7	·4559	35·40	·1936	270·60	·3250	330·12
June 24	96	26·6	·4566	33·37	·1930	270·08	·3247	330·01
Aug. 23	96	24·4	·4573	31·35	·1924	269·58	·3245	329·90
Oct. 22	96	22·1	·4581	29·32	·1918	269·10	·3244	329·80
Dec. 21	0·0096	19·7	0·4589	27·29	0·1913	268·64	0·3245	329·70

Correction to the Ephemeris of the Satellites of Uranus.

On page 97 the values of the position angles p_o are, by mistake, wrongly given. The correct values are as much above 10° as the printed ones are below 10°, or the true values are found by subtracting the printed ones from 20°. Thus

	°		°
For	8·13	*read*	11·87
,,	8·19	,,	11·81
	*	*	*
,,	8·95	,,	11·05.

Observations of Occultations of Stars by the Moon, and of Phenomena of Jupiter's Satellites, made at the Royal Observatory, Greenwich, in the year 1877.

(*Communicated by the Astronomer Royal.*)

Occultations of Stars by the Moon.

Day of Obs. 1877.	Phenomenon.	Telescope.	Power.	Moon's Limb.	Mean Solar Time of Observation. h m s	Observer.
Jan. 30	Reapp. of 45 Leonis	Altaz.	100	Dark	9 15 50·3	A.D.
,,	Disapp. of ρ Leonis	,,	,,	Bright	10 51 19·4	,,
,,	Reapp. of ρ Leonis	,,	,,	Dark	11 57 2·8	,,
Feb. 26	Disapp. of Regulus	E. Eq.	140	,,	12 45 43·8	M.
,, (*a*)	,, ,,	S.E. Eq.	285	,,	12 45 44·0	W.C.
,,	,, ,,	Altaz.	100	,,	12 45 44·3	A.D.
Mar. 21	,, Piazzi V. 136	,,	,,	,,	10 20 31·9	T.
Nov. 20 (*b*)	,, 19 Tauri	S.E. Eq.	130	Bright	7 42 19·7	M.
,, (*c*)	,, 20 Tauri	,,	,,	,,	7 49 40·0	,,
,,	Reapp. of 17 Tauri	,,	,,	,,	8 10 31·1	,,
,,	,, 19 Tauri	,,	60	,,	8 39 10·9	,,
,, (*d*)	,, 20 Tauri	,,	,,	,,	8 55 55·5	,,